Mobile Restaurant Information System Integrating Reservation Navigating and Parking Management

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***Abstract*—In recent years, with the pace of technological development, people have become more and more demanding in terms of quality of life. At the same time the restaurant industry has become one of the largest industries in the world. To follow international trends and development in the restaurant business in Taiwan, various types of theme restaurants and cafes have emerged. Needless to say competition is intense. In such an environment, raising service quality and management performance are the foremost goals; informatization is the key to these goals.**

A restaurant information system is the digital nervous system of restaurant management, containing all the relevant processes. Management can understand operational conditions through a restaurant information system and respond to them. They can become aware of competitor challenges or customer needs and then formulate strategies accordingly. A restaurant information system combines software and hardware; it provides restaurant management with precise, direct, and abundant information, which can enhance insight and productivity.

This study developed a restaurant information system aimed at online restaurant services and information management. Combined with a parking management system and GPS navigating technology, this powerful system applies object-oriented techniques; the extensibility of object-oriented systems allows integration with different information system cores, providing diversified management and new informational services. Functions can be easily extended, increasing the flexibility of the system. This information system can enhance competition, create overall advantage, and increase operational efficiency and performance.

Keyword- service quality, restaurant information system, object-oriented system, GPS

I. INTRODUCTION

In the development of technology in recent years, informatization has become a symbol of organization progress and an indispensable instrument for survival. Organizations that cannot incorporate information systems into their structures may become disconnected from the industry, further causing decline in competitiveness. As a result, informatization is now a vital direction in organization development. How to effectively take advantage of information systems or even re-organize to incorporate informatization is currently an important issue. The restaurant industry is naturally no exception to this trend. However, in comparison with other industries, advances in informatization are more sluggish in the restaurant industry; research on restaurant information systems is also notably lacking. With regard to the substantial demands of this market, information in many aspects is inadequate.

A restaurant business magazine in the US once conducted a study on information systems for the restaurant industry. They observed that the primary uses of computers in this industry were accounts receivable, employee salaries, menu analyses, inventory control, food service control, employee work schedules, creating and processing tables or documents, kitchen production, and printing menus. According to their statistical analysis, large-scale restaurants and, in particular, restaurants in tourist hotels are almost completely dependant on computers to process these affairs [1, 2]. Ten years ago, using cash registers to manage cash was common in the restaurant industry. Today, cash registers have been replaced by point of sale (POS) terminals. Although new POS computers system are still cash based, management can obtain additional information such as monitoring of items sold, materials used, and employee work efficiency. They can even calculate wages and the amount of tips due. The main computer, linked to the POS terminals by Internet connection, provides information such as accounting records and food purchases to obtain desired values [3, 4].

However of all the factors considered by restaurant business management, a convenient location is the most essential. Parking spaces in the city are limited, and so is the number of parking spaces that can be provided by

any restaurant. Therefore maintaining a mechanism or system is necessary for planning and management. Automation of the restaurant industry is an inevitable development. Via restaurant information systems, overall management performance can be enhanced. Computerization of procedures can also increase productivity, whereas operation costs can be more efficient and thus reduced. Information systems can provide more convenient services of many varieties, thereby gradually increasing customer satisfaction.

This study endeavored to establish a breakthrough in past concepts that focused restaurant systems on only ordering. Including a wireless ordering system, a parking management system, and a GPS navigation module, the system in this study increases added value by providing innovative services and functions. In the ordering system, restaurant employees can access up-to-date information, event notices, contacts, and forums through the platform, establishing a complete communication channel connecting the organization internally from top to bottom. With the simple interface and operation steps, previous issues of complicated procedures and adverse interaction mechanisms can easily be solved.

The mechanism of online meal ordering was the focal point of our ordering system in light of issues resulting from conventional eating-in at restaurants. Using the parking management system, restaurant employees can control internal parking lots and conduct information management for parking lots with special arrangements. Consumers can search for information on parking spaces in the restaurant parking lots or be navigated to other special arrangement parking lots by GPS. This provides the restaurant with internal control mechanisms for parking spaces and the consumers with real-time information services, all with an easy-to-use interface as well as simple operation steps. The procedure of the parking guidance is shown in Fig. 1.

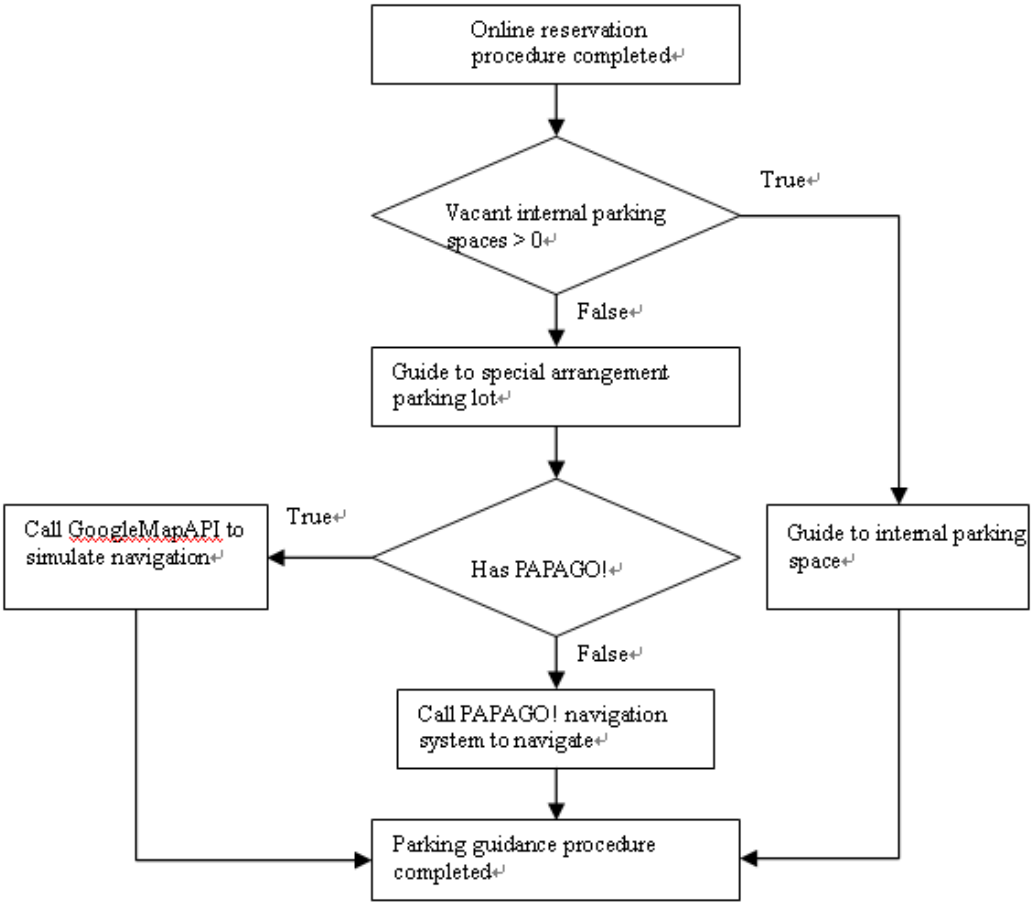

Fig. 1. Procedure of Parking Guidance

Creating a GPS navigation service mechanism was also another priority in our restaurant information system. An external service core was adopted in order to address the issues extending from the limited number of spaces in internal parking lots of restaurants. The framework of this system is displayed in Fig. 2. As a whole, the objective of developing this restaurant information system is to reduce unnecessary waste in manpower, time, resources, and costs and establish a system with efficiency, quality, and innovation.

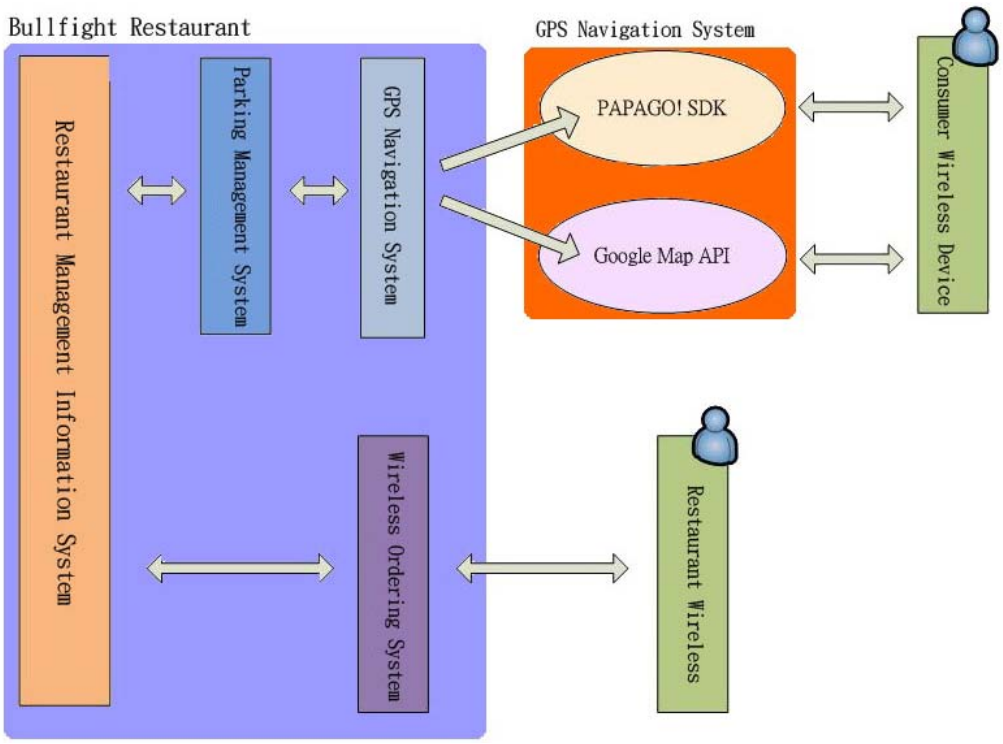

Fig. 2. Framework of Point Functional System

II. Literature Review

ASP.NET is an environment compiled with .NET Framework; any languages supported by .NET (including Visual Basic .NET, C#, and JScript .NET) can be used to write applications. In addition, the entire .NET Framework is available for use of ASP.NET applications. Developers can easily take advantage of the techniques on offer, such as the Managed Common Language Runtime environment, type safety, and inheritance. ASP.NET has been designed to work with WYSIWYG HTML editors and other programming tools (including Microsoft Visual Studio .NET) seamlessly [5, 6]. This not only facilitates the development of Web but also provides the tools with required functionality; developers can place server controls into GUI on Web webpages or completely integrate debug support. When building ASP.NET applications, developers can select two functions, Web Form or Web service, or a combination of the two, in any way that appears appropriate. Both functions are supported by the same basic structure, allowing use of authentication configuration, cache of frequently used data, or customization of application configurations.

Request/response communication between conventional webpage browsers and servers adopt synchronous communication; AJAX is a type of asynchronous communication with a three-layered structure, shown in Figures 3 and 4. When an AJAX engine is included between browser and server, the AJAX engine is in fact situated on the browser end. Its operation process is as follows:

1. The user performs an action on the browser, for example, pressing a button or typing in text, and triggers a JavaScript function.

2. In the background, the AJAX engine sends an http request to the server. As soon as the AJAX engine makes the request, the JavaScript call is transmitted back to the caller. This is termed asynchronous communication. When the AJAX engine receives the http response from the server, the AJAX engine will directly call the corresponding function to notify the browser, which produces a reaction on the user interface [7, 8]. A detailed comparison is shown in Fig. 3 and 4.

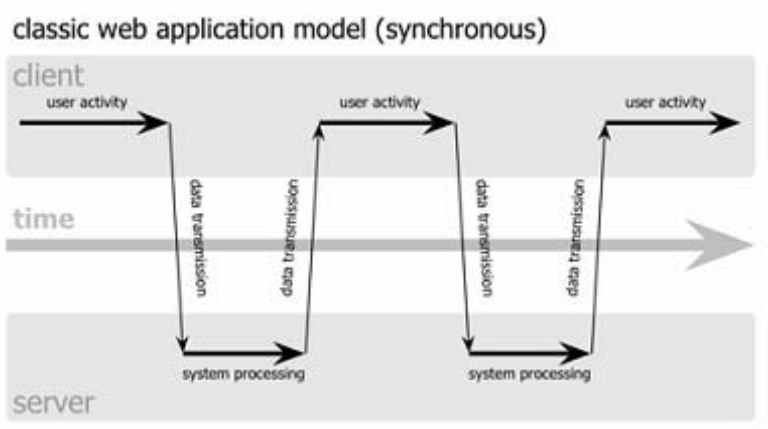

Fig. 3. Structure of Synchronous Communication in Conventional Webpage Browsers

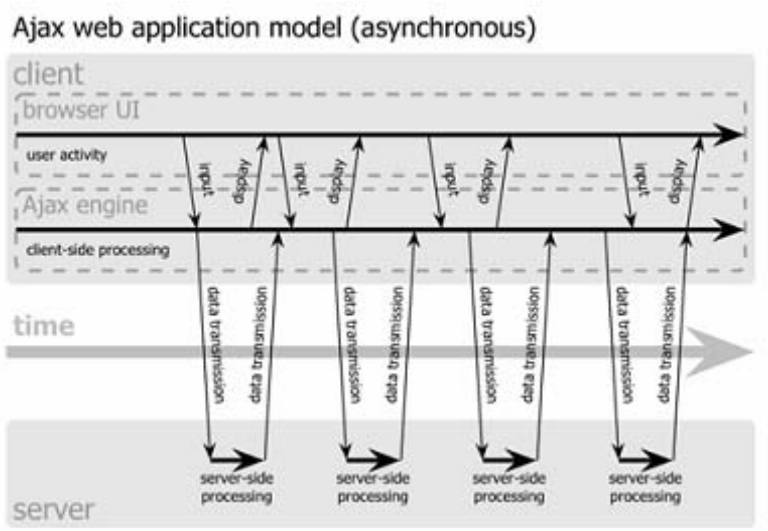

Fig. 4. Structure of Asynchronous Communication in AJAX Webpage

The GPS can orientate three-dimensional locations by triangulation. Two-dimensional locations can be calculated with data from two distinct satellites. However, data from a third satellite is usually included to correct and revise errors. Similarly, to obtain more precise three-dimensional locations, data from a fourth satellite in addition to that from the basic three satellites is often included to eliminate and revise possible errors in positioning. In general, users only need to confirm that their GPS receiver is obtaining data from four or more satellites; positioning information can thus be calculated more precisely and effectively used in application [9].

III. METHODOLOGY

Different forms of restaurant service impose different requirements on information systems. Standardized service or dishes can reduce the complexity of the system design and maintain costs; therefore an adequate restaurant information system is not only a complete hardware and software facility but is also a comprehensive integration of a business model with service functionality. This study adopted the System Development Life Cycle (SDLC) as the core process; the procedure steps are explained below:

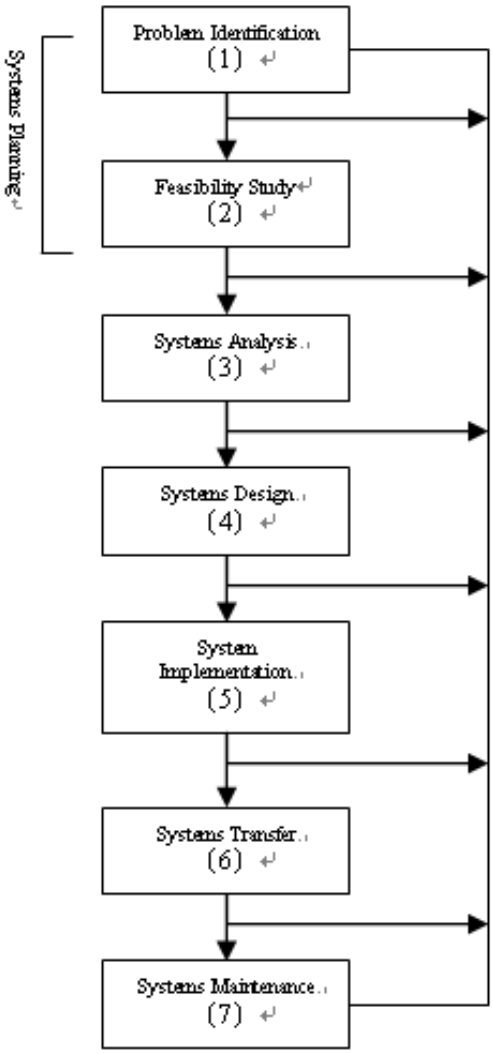

Fig. 5. Procedure of Study

(1)Problem identification:

In problem identification, necessary conditions and requirements to establish the restaurant information system were first identified through relevant domestic and overseas researches. With the cooperation of the study company, restaurant operation was observed to induce better knowledge of the restaurant industry. As a result, the design of the new system was closer to the information needs of the restaurant industry.

(2)Feasibility study:

The feasibility of this study was determined through two aspects: economic feasibility and operational feasibility.

(A) Economic feasibility:

This study employed the return on investment method and the payback period method to confirm whether this restaurant management system is economically feasible for the cooperating study company. The methods are explained below:

a. The return on investment method (ROI), ROI=(P-C/N)/(C/2)

where P is net profit; N is the investment period; and C is the amount of money invested. An ROI lower than investment costs, usually expressed using market interest rate, indicates that the system is worth the investment.

b. The payback period method (PPM): PPM=C/P

where C is the amount of money invested, and P is the amount of annual cash recovery. The shorter the payback period derived, the more the system is worth investing in.

(B) Operational feasibility:

The focus of this part of the study is to analyze whether the solution proposed in this study is applicable in the study company. The degree of acceptance by the users in this system is also one of the items in analysis; supervisors or employees at the restaurant and online customers are all users of this system. This portion relies on cooperation by the study company; expectations and criticism of the supervisors and employees were

understood by way of interview. Factors that exert impact on website quality conceived by users include the aesthetics of webpage appearance and whether the interface is easy to use. This information was subsumed as a reference in the establishment of the Internet services. For details relevant to the operational analysis, please refer to TABLE I.

TABLE I

Analysis of Operational Feasibility

	Internet		Intranet	
	Rule A	**Rule B**	**Rule C**	**Rule D**
User Acceptance				
Restaurant Supervisor	Accept	Decline	Decline	Accept
Restaurant Employee	Accept	Decline	Decline	Accept
Restaurant Customer	Accept	Accept	Decline	Accept
Organization Applicability				
Management Unit	Accept	Decline	Decline	Accept
Dining Area Service	Accept	Decline	Decline	Accept
Kitchen Area Service	Accept	N/A	N/A	N/A
	√			√
	The Rules included in the evaluation in this study are explained as follows: Rule A: Wireless ordering system established; ordering procedure simplified; time for ordering reduced. Rule B: Reservations can be made online, allowing customers to reserve selected tables through the Internet. Rule C: Self-help terminals are installed at the entrance of the restaurant or at each table, enabling customers to choose dishes and services themselves. Rule D: A terminal is installed only at the counter, through which reception personnel input service information after inquiring of customers.			

The results of the evaluation indicated that Rule B and Rule C had to be discarded, the reasons for which are: (1) Rule B: Many situations arise at the scene of the restaurant and are difficult to predict, hindering order service at the tables; disputes occur easily. Hence, having restaurant employees allocate services depending on the situation was a better option. (2) Rule C: Customers hope to enjoy more and better services; although a self-help computer system is more advanced, it lacks the human touch. Furthermore, service personnel were worried that the system would affect their right to work, creating strong aversion.

(3) Systems analysis, implementation, and maintenance:

The analysis above brought forth the following conclusion: “Establishing a wireless ordering system is accepted by users within and outside the organization. The system complies with the requirements of the restaurant. Installing the dining area service system at the counter is more appropriate since it is where the center for transmitting information to the kitchen is.” In addition, for the system to achieve the expected results after deployment, all users must be able to accept the changes in procedure and operation that the system will bring.

After understanding the detailed needs of the cooperating enterprise, we concluded that the enterprise required enhancement of the ordering system and solutions to parking issues. Thus, this study employed prototyping to establish the planned restaurant system. The objective of this portion was to confirm the feasibility, integrity, and applicability of the system, allowing the study company to clearly understand whether the future functions of the system meet their requirements. In addition to the relevant management systems mentioned before, this study also built a counter management information system, the functions of which include:

(A)Quick functions: Functions commonly used on the restaurant floor are placed in this area, including ordering meals, paying the check, joining tables, changing tables, reserving tables, and ordering out.

(B)Update table status: After any operations at the counter, the update table status button must be clicked. In this way, any linked computers or PDAs are also updated for the latest table status.

The above constitutes the prototype of the restaurant information system in regards to internal management. For meal ordering, a PDA human machine interface program was written for internal wireless terminals, easy for employees taking orders to use.

In parking management, a parking space is automatically issued to the consumer following online reservation and reserved for a set time limit for automation control. The number of vacant parking spaces is automatically updated by the system. An interface in the system allows easy look-up by restaurant employees and consumers. When there are no more parking spaces in the internal parking lot, a GPS navigating service will be provided. Users can select navigation systems. As there are many navigation systems on the market with different systems, we opted to have our system support the well-known cross-platform navigation system, PAPAGO! For users with other navigation systems or no navigation systems at all, simulation navigating was also supplied using GoogleMapAPI, enhancing usability greatly [10, 11].

IV. Results

In addition to installing basic network facilities, this study also installed POS hardware equipment in accordance with the needs of the physical store and the needs of the information system. The technology of this hardware is already mature; there is little difference between products of various manufacturers. Thus, there is no really good or bad equipment, only equipment that is either suitable or not suitable. The configuration of system equipment is shown in Fig. 6.

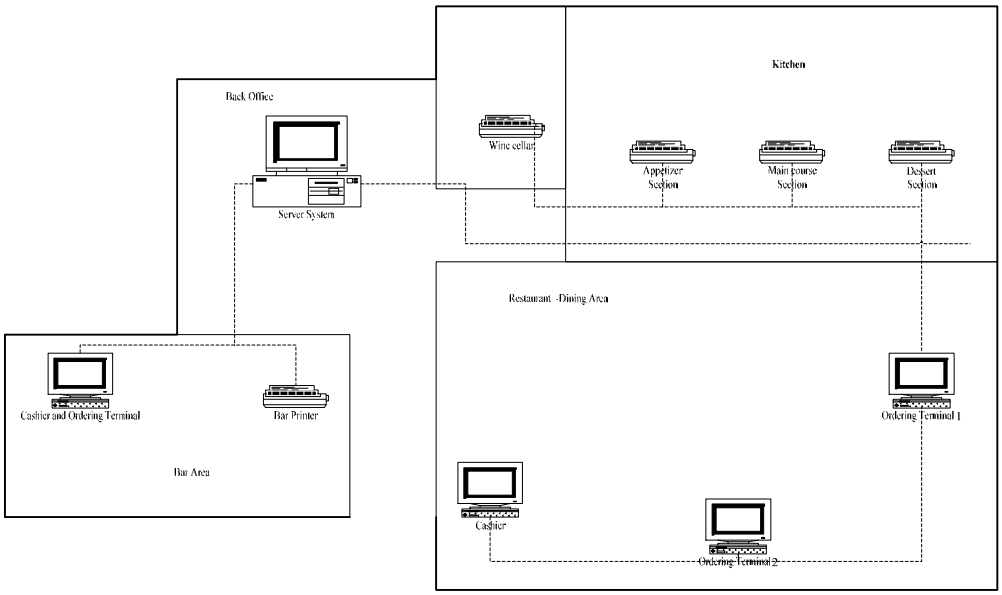

Fig. 6. Configuration of System Equipment

After understanding the detailed needs of the cooperating enterprise, it was concluded that they required enhancement of the meal ordering system and solutions to parking issues. Images in the restaurant system and the results of system benefits are as shown below:

(1) System images at the counter terminal:

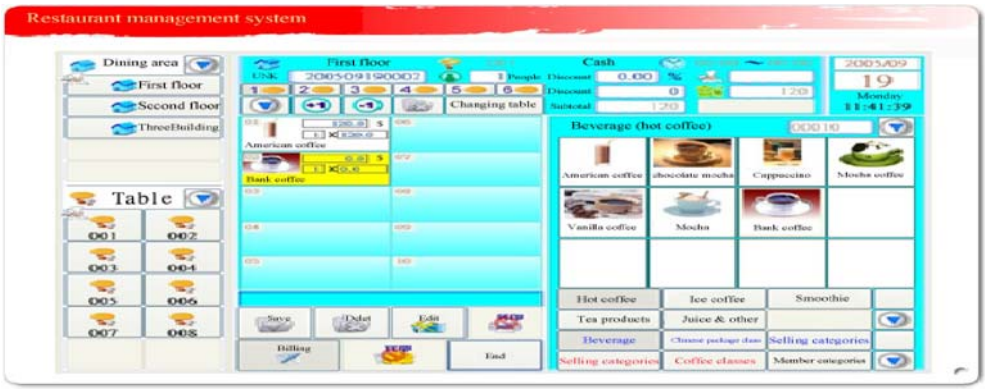

Fig. 7. System Images at Counter Terminal-1

Fig. 8. System Images at Counter Terminal-2

(2) System images in GPS simulation navigating:

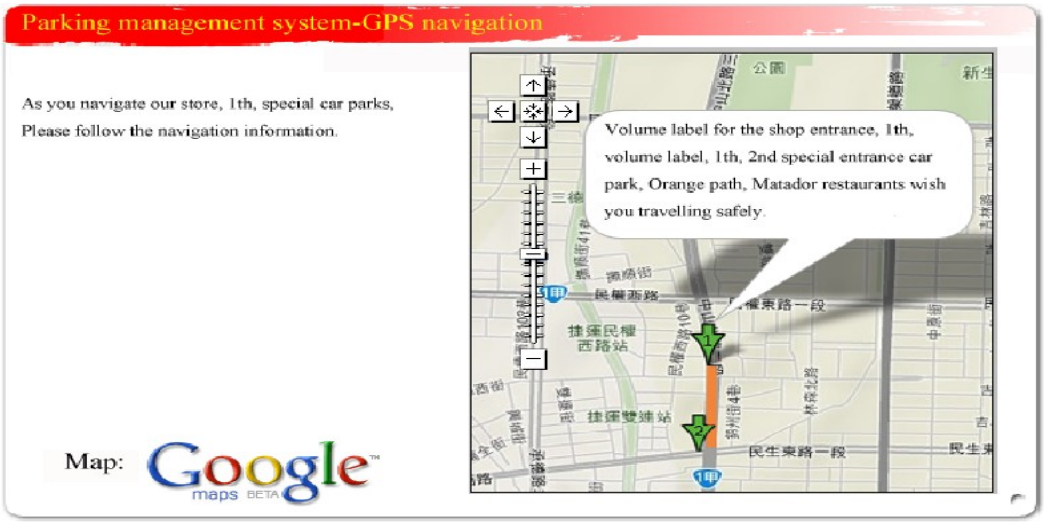

Fig. 9. System Images in GPS Simulation Navigating

(3) The benefits of the system developed in this study include: (A) complete and exact display of financial statements, (B) clear invoicing reports, (C) complete and detailed analysis tools, (D) enhancement of enterprise image and competitiveness, (E) stable reliability, (F) fast operation procedures, (G) low maintenance costs, (H) parking space control and provision of innovative information services.

V. Conclusion

The objective of this study was to establish a restaurant information system for the study company, a well-known steak restaurant chain. This restaurant has been operating in the restaurant industry for a long time; to avoid losing competitiveness and advantage in a society that emphasizes differentiation, they hoped to address the issues they could not solve with the system established in this study. The system is composed of four technologies: restaurant management, parking management, GPS navigation, and the Internet. The last is applied to build an informatized service platform. The restaurant management system provides functions that can reduce operation costs, reduce waste in human resources, increase meal ordering efficiency, and allow management to grasp operation conditions easily. The parking management system adopts automated control, alleviating the burden on management. GPS navigating provides an innovative information service that reduces complications in parking for consumers and raises consumer willingness to return to the establishment. This system can further enhance the competitiveness of the restaurant and establish the restaurant's standing in the industry.

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